Variation in Perioperative Antibiotic Use for Children Undergoing Congenital Heart Disease Surgery in U.S. Academically Affiliated Centers

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Introduction

- National guidelines recommend narrow-spectrum and short-duration preoperative antibiotics (PA) for congenital heart disease (CHD) surgery, but actual practice is not well known

- This study characterizes variation in narrow-spectrum vs. broad-spectrum and short- vs. long-duration PA in US academic medical centers within the CHD surgical population

Methods

Design: Cohort study using Vizient CBD/RM administrative database containing ICD-9 & 10 procedure & diagnosis codes and medication data from >100 academically affiliated centers

Figure 1: Participants

Eligibility Assessed
Pediatric admissions from 2011-2018

Inclusion Criteria
(n=27438 admissions; 50 centers)
- Children 0-17 years
- Billing code for non-catheterization CHD surgery

Exclusion Criteria
(n=8286 admissions)
- Antibiotics day prior to surgery/concern for pre-existing infection (n=3432)
- No IV antibiotics (n= 1894)
- Only IV antibiotics are penicillin/ampicillin (n=12)
- Heart transplant (n=193)
- Concurrent non-cardiac surgery (n=288)
- Missing data (n=2367)
- Centers with annual surgical volume <5 (n=100)

Final Cohort (n=19152 admissions, 24 Centers)

Exposure:
- PA: any IV antibiotic administered starting on day of surgery
- Narrow-spectrum: PA limited to first- or second-generation cephalosporin (ie cefazolin)
- Broad-spectrum: PA includes any class of IV antibiotic with broader spectrum (ie vancomycin)
- Short-duration: PA for one to two days
- Long-duration: PA continued three or more days

Results

Table 1: Duration of Perioperative Antibiotics

	Overall	Short (1-2 days)	Long (3+ days)
Participants, n (%)	19,152	8,393 (43.8)	10,759 (56.2) (A)

Table 2: Characteristics of 19152 Admissions with Congenital Heart Disease Surgery from 2011-2018, by Spectrum of Perioperative Antibiotics

	Overall	Narrow-spectrum PA	Broad-spectrum PA	P-value
Total, n (%)	19,152	15,050 (78.6)	4,102 (21.4) (B)	
Age, n (%)				<0.001[1]
0-30 days	3,575	2,411 (67.4)	1,164 (32.6) (D)	
1-11 months	7,053	5,819 (82.5)	1,234 (17.5)	
1-17 years	8,524	6,820 (80.0)	1,704 (20.0)	
Premature, n (%)	1,042	749 (71.9)	293 (28.1)	<0.001[1]
RACHS-1 Score, n (%)				<0.001[1]
1 *(less complex)*	2,334	1,998 (85.6)	336 (14.4)	
2	7,101	5,851 (82.4)	1,250 (17.6)	
3	6,646	5,154 (77.6)	1,492 (22.4)	
4	1,530	1,036 (67.7)	494 (32.2)	
5/6 *(more complex)*	516	217 (42.0)	299 (58.0) (E)	
Unclassified	1,025	794 (77.5)	231 (22.5)	
Noncardiac congenital malformation, n (%)	1,622	1161 (71.6)	461 (28.4)	<0.001[1]
Delayed sternal closure, n (%)	1097	366 (33.4)	731 (66.6) (F)	<0.001[1]
Periop ECLS, n (%)	431	190 (44.1)	241 (55.9)	<0.001[1]
# of vasoactives day of surgery, median (IQR)	1 (1-2)	1 (1-2)	2 (1-3)	<0.001[2]

Table 3: Unadjusted Outcomes, by Spectrum of PA

	Overall, n (%)	Narrow PA, n (%)	Broad PA, n (%) (G)	P-value
Length of post-op stay, median (IQR)	7 (4 -13)	6 (4 -11)	9 (5 – 22)	<0.001[2]
In-hospital mortality	461 (2.4)	240 (1.6)	221 (5.4)	<0.001[1]

P-values obtained by [1]Chi-square; [2]Nonparametric equality-of-medians
Abbreviations: ECLS, extracorporeal life support; IQR Interquartile range; RACHS-1: Risk Adjusted Cardiac Surgical Score

Figure 2: Broad-spectrum PA use Varies from 1.5 to 95% by Center (C)

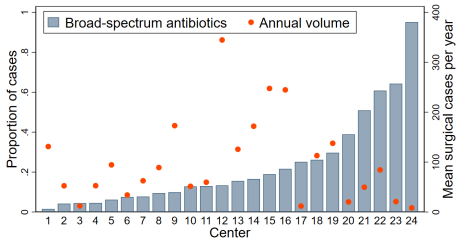


Figure 2: We observed significant variability in rates of broad-spectrum PA between centers, with smaller volume centers comprising many of the lowest and highest use

Figure 3: Antibiotic Combinations Comprising Broad-spectrum PA, by Center

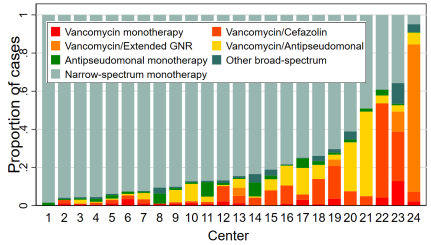
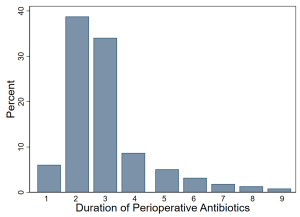


Figure 3: Vancomycin-containing regimens comprise the majority of broad-spectrum PA, with vancomycin use varying from 0-81% between centers

Figure 4: Distribution of PA Duration, in Days



Conclusions

- A majority of patients (56.2%) receive long-duration PA **(A)**
- A minority of patients (21.4%) receive broad-spectrum PA **(B)**, with considerable variation between centers **(C)**
- Rates of exposure to broad-spectrum PA are higher in patients 0-30days (32.6%) compared to 1-11 months (17.5%) and 1-17 years (20.0%) **(D)**
- Rates of exposure to broad-spectrum PA are highest in those with high-complexity RACHS-1 scores (58.0%) **(E)** and delayed sternal closure (66.6%) **(F)**
- Unadjusted length of stay and mortality is significantly higher in patients who receive broad-spectrum PA **(G)**
- Standardizing perioperative antibiotic practices in CHD surgery is a potential high-yield area to limit unnecessary pediatric antibiotic exposure